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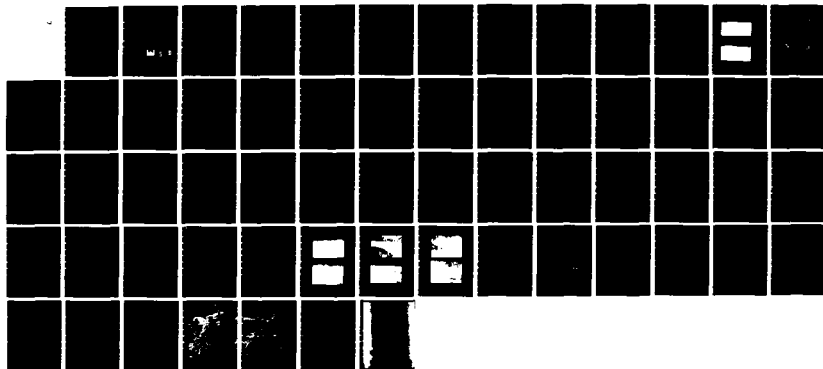
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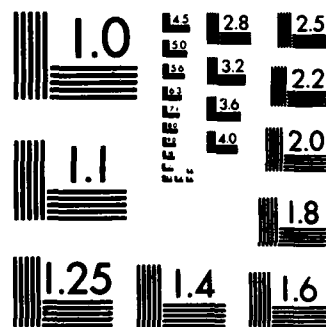
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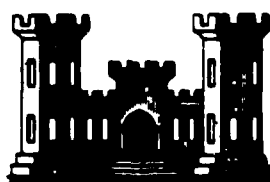
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HOUSATONIC RIVER BASIN
DANBURY, CONNECTICUT

MARGERIE LAKE RESERVOIR DAM
CT 00063

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Margerie Lake Reservoir Dam is an earthfill embankment about 735 ft. long with a maximum height of about 28.5 ft. and a crest width of 10 ft. It is located at the south end of the reservoir. The dike at the north end is also an earthfill embankment, about 1,104 ft. long with a maximum height of about 16 ft. The spillway is located at the right abutment of the main dam, consisting of a 30 ft. wide channel cut through the abutment, all or mostly in ledge rock, and a 1.2 ft. high concrete control sill with its crest 6.5 ft. below the crest of the dam.		

MARGERIE LAKE RESERVOIR DAM

CT 00063

HOUSATONIC RIVER BASIN
DANBURY, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No. CT 00063
Name of Dam: Margerie Lake Reservoir Dam
Town: Danbury
County and State: Fairfield County, Connecticut
Stream: Tributary of Padanaram Brook
Date of Inspection: 23 October 1978

BRIEF ASSESSMENT

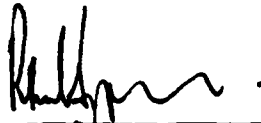
Margerie Lake Reservoir Dam is an earthfill embankment about 735 ft. long with a maximum height of about 28.5 ft. and a crest width of 10 ft. It is located at the south end of the reservoir. The dike at the north end is also an earthfill embankment, about 1,104 ft. long with a maximum height of about 16 ft. The spillway is located at the right abutment of the main dam, consisting of a 30 ft. wide channel cut through the abutment, all or mostly in ledge rock, and a 1.2 ft. high concrete control sill with its crest 6.5 ft. below the crest of the dam. The outlet tower is located to the right of center of the dam, near the low point of the valley. The outlet is a 30 in. dia. pipe through the dam and continued in buried trench to the filter plant about 600 ft. south of the dam. No bypass or blowoff from this outlet has been provided.

Margerie Lake Reservoir is utilized as a water storage facility for the City of Danbury. It is about 8,600 ft. long and has a surface at normal storage of 244 acres. The drainage area is 1.26 square miles, the normal storage is 4,270 acre-ft., and the maximum storage to top of dam is 6,100 acre-ft.; the size classification is thus intermediate. Because of the threat to life and property which would result if the dam or dike were breached, it has been classified as having a high hazard potential.

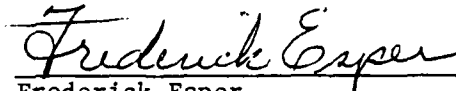
The dam appears to be in good condition. The spillway is adequate to pass the full PMF test flood without overtopping the dam. The north dike also appears to be in good condition. Seepage at the downstream toe of the dam was noted. A toe drain at the north dike appears to be functioning as intended. The outlet control valves may not be serviceable.

Within two years of the receipt of the Phase I Inspection Report, the owner, the City of Danbury, should retain the services of a competent registered professional engineer and implement the results of his evaluation of the need for provision of additional drawdown capability. The owner should also implement the following

maintenance measures: keep brush growth cut on both embankments and in the spillway channel; fill small chuckholes on the main dam and replace missing riprap on the north dike; monitor seepages periodically at both main dam and north dike during periods of high reservoir level; check that outlet gates are serviceable; develop a formal flood warning system and emergency operational procedure.



Peter B. Dyson
Project Manager



Frederick Esper
Vice President



This Phase I Inspection Report on Margerie Lake Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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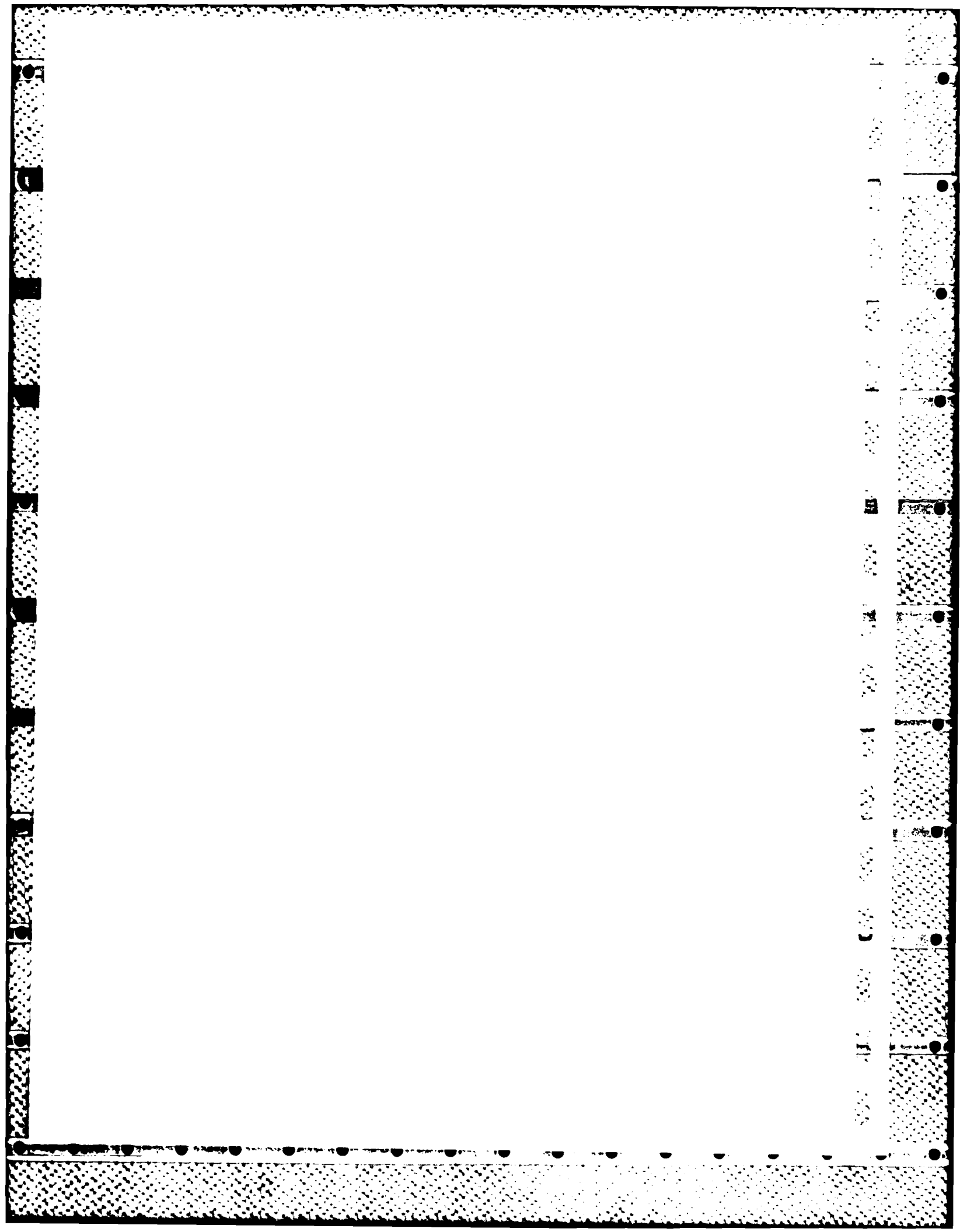
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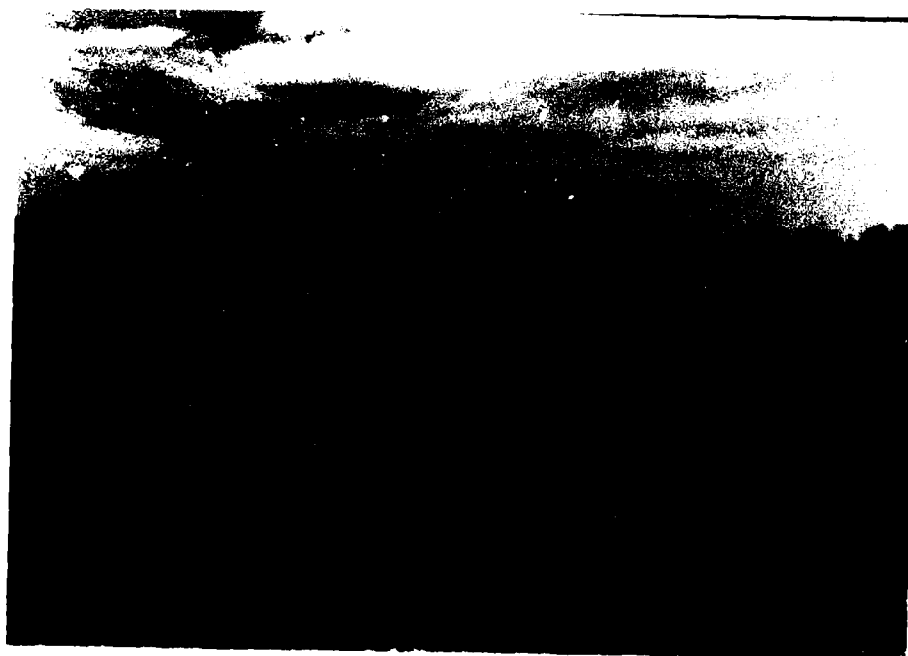
APPENDIX E - INFORMATION AS CONTAINED IN THE
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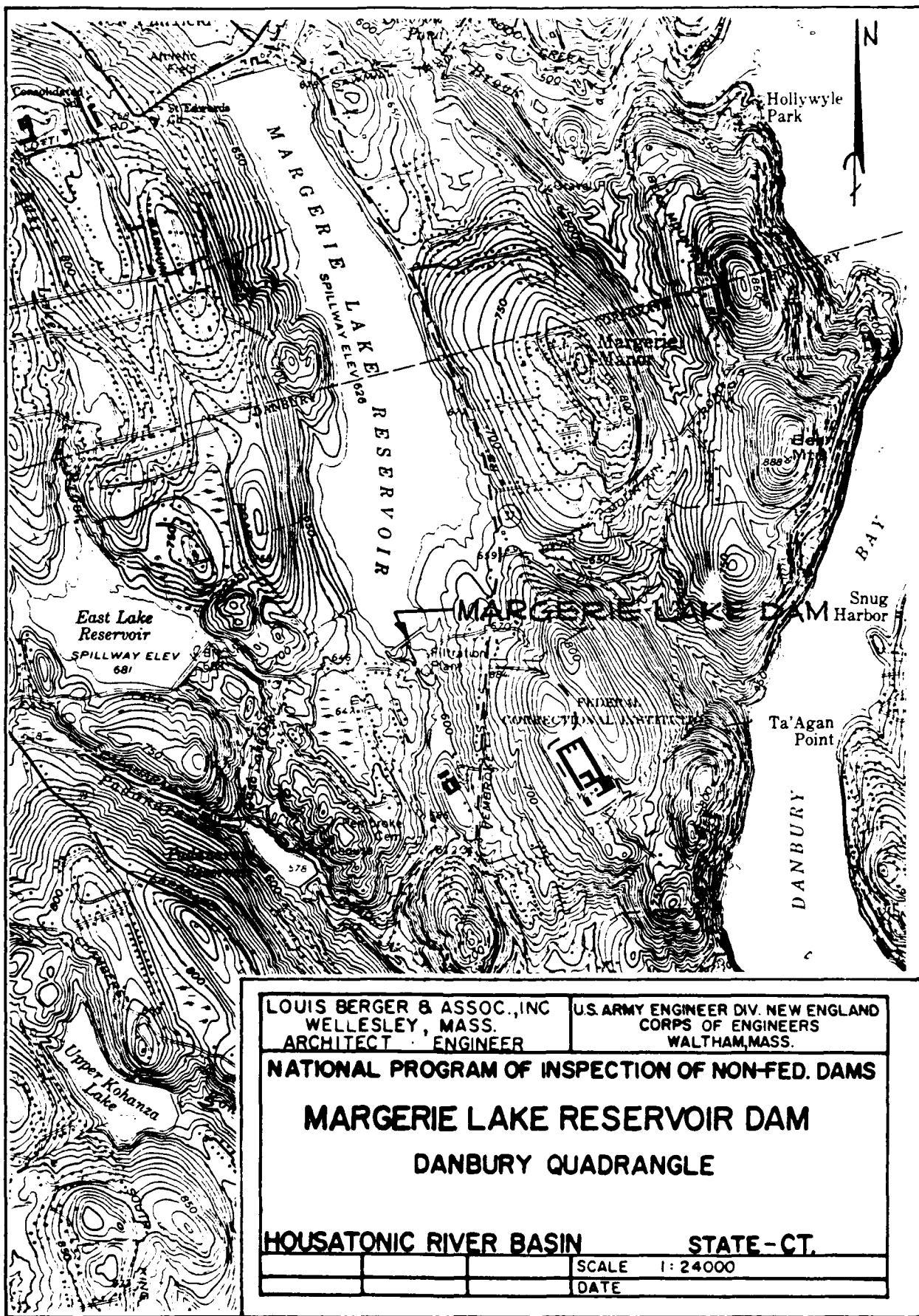
MARGERIE LAKE RESERVOIR DAM



Overview from left abutment



Overview from right abutment



PHASE I INSPECTION REPORT

MARGERIE LAKE RESERVOIR DAM CT 00063

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 24 August 1973 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0371 has been assigned by the Corps of Engineers for this work.

b. Purpose

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Margerie Lake Reservoir is located about 2½ miles north of the City of Danbury in Fairfield County, southwestern Connecticut. The reservoir is situated in a crest saddle between two small drainage basins, that of Padanaram Brook leading to Still River to the south and that of Ball Pond Brook leading to Lake Candlewood to the north and east.

The normal storage level in Margerie Lake Reservoir is at elevation 626. Where Padanaram Brook meets the Still River, a distance of about 3.4 miles from Margerie Lake Dam, the elevation is about 385. Where Ball Pond Brook empties into Lake Candlewood, about 1.6 miles below Margerie Lake Reservoir north dike, the elevation is 499. The reservoir is utilized as a storage facility for the municipal water supply of the City of Danbury.

b. Description of Dam and Appurtenances

1. Description of Main Dam and North Dike

The main dam is located at the south end of the reservoir in Danbury, below which the filter plant for the City of Danbury Water Department is situated. The dam is sited where the saddle begins to drop away and where the valley width pinches to about 750 ft. The dam at this site is about 28.5 ft. high measured from natural ground level.

The Margerie Lake Dam is a compacted earthfill embankment having a crest width of approximately 10 ft. and with a $2\frac{1}{2}$ to 1 upstream slope and 2 to 1 downstream slope. The dam is approximately 735 ft. long at the crest and has a maximum height of 18.5 ft. The upstream slope is covered with hand-placed rock riprap approximately 18 in. thick. The downstream slope is covered with sod. The lower portion of the downstream slope for a slope distance of 10 to 15 ft. measured from the toe is covered with a rock facing, apparently for seepage control. This rock area extends from a point approximately 80 ft. left of the concrete outlet structure almost to the right abutment. There is no information available on the embankment cross-section in terms of zoning or other details such as cutoff trench. There is a massive granitic type bedrock exposed on the right abutment where the spillway is located. Thus, it is probable that at least on the right abutment side of the dam, the base of the dam is in contact with bedrock. However, as stated, no details are available on cutoff trench or zoning of the embankment.

The closure dike is located about 8,700 ft. to the north of the main dam in New Fairfield, where the saddle area begins to drop off towards Ball Pond Brook. The valley width at this site is about 1,100 ft. The dike varies in height along its length, to a maximum of about 16 ft. above natural ground level. The alignment of the dike is somewhat irregular, having a slight bow downstream for about a mid-third of its length.

The dike is a compacted earthfill embankment with a crest width of approximately 10 ft. and somewhat variable downstream and upstream slopes, generally averaging about 2 horizontal to 1 vertical. The dike has a crest length of approximately 1,100 ft. The upstream slope is covered with an 18 in. thick layer of rock riprap. The downstream slope is covered with sod which has been invaded by light brush growth.

There is a drainage ditch along the toe of the downstream slope of the dike. This drainage ditch serves to pick up runoff from the shopping center located immediately to the north of the dike, and thus would function only during periods of rainfall and runoff. The only other apparent feature to the dike is a well with manhole cover located at the downstream toe approximately 150 to 200 ft. left of the left abutment. There is a pipe outlet located in the well approximately 13 ft. lower than the manhole rim, about 10 ft. below the crest of the dike. This manhole well is believed to be a collecting point for an internal seepage collecting system within the downstream portion of the dike. However, no design drawings or as-built plans showing details are available to verify this.

Sketch plans and profiles of the dam and dike are delineated on Figures 1 and 2 in Appendix B.

2. Spillway

The spillway for Margerie Lake Reservoir is located at the right abutment of the main dam and consists of a 30 ft. wide channel cut through the abutment. The channel narrows as it continues down the abutment slope and daylights some 200 ft. below the dam near stream level.

Except for a retaining and guide wall on the left side of the channel where the spillway abuts the dam embankment, the channel is unlined. The right side of the spillway opposite the main dam section is exposed ledge rock, and it is believed that most if not all of the bottom across the channel is also ledge rock. The channel is cut to a depth of 1.2 ft. below normal reservoir storage level elevation 626, and a concrete sill 2 ft. wide by 1.2 ft. high is built across the channel as a control.

The concrete guide wall on the left side of the channel extends about 75 ft. downstream from the concrete sill block. The excavated channel for this distance is about 1.2 ft. lower than the top of the sill block and is lined with hand-placed riprap.¹⁰ Beyond this level section, the channel slopes and converges, narrowing to about 18 ft. in a distance of 60 ft. The channel bottom for this length is also riprapped.

3. Outlets

The reservoir outlet is located to the right of the center length of the main dam, near the low point of the valley. The outlet is a 30 in. dia. pipe placed through the dam and continued in buried trench to the filter plant about 1,000 ft. south of the dam. No bypass or blowoff from this outlet pipe has been provided.

Valves to control outlet releases from the reservoir are located at an intake tower on the upstream face of the dam. The inlet to the intake tower is trashracked to exclude large debris, and a 6 ft. by 6 ft. bulkhead gate is provided to bulkhead off the intake tower. Two gate valves in tandem are provided for regulating releases into the outlet pipe. These valves are presumably 30 in. dia., the same as the outlet pipe. Control valves are also located at the filter plant; and during normal plant operation, these valves are used to regulate withdrawals from the reservoir. The gate and valves at the dam are now left open, and whether they are readily operable is questionable.

c. Size Classification

The Margerie Dam is about 28.5 ft. high, impounding a maximum storage of about 4,200 acre-ft. to spillway crest level and about 6,100 acre-ft. to top of dam. In accordance with size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, storage governs and therefore the project is classified as intermediate in size.

d. Hazard Classification

A breach failure at the main dam at Margerie Lake Reservoir would release water down to Padanaram Brook and thence into Still River which traverses the City of Danbury. The main filter plant for Danbury water supply lies directly below the dam and would be inundated by a breach flow from the

reservoir. At least 25 homes, a number of roadside commercial establishments, part of the Abbott Technical School and Route 37 could be affected by a flood depth of the order of 15 ft. South of Interstate Route 85 it is probable that more densely populated areas of Danbury would also be affected.

A breach failure of the north dike would spill flows directly onto the several commercial establishments constructed practically at the toe of the dike.

It therefore appears that a sudden breach of the dam would probably cause some loss of life and appreciable economic loss. Consequently, Margerie Lake Reservoir Dam has been classified as having high hazard potential in accordance with the Recommended Guidelines for the Safety Inspection of Dams.

e. Ownership

The Margerie Lake Reservoir dam and dike are owned by the City of Danbury.

f. Operator

Mr. Ralph Welch
Superintendent of Public Utilities
Danbury City Hall
155 Deer Street
Danbury, CT 06810

Telephone: (203) 797-4537

g. Purpose of Dam

The Margerie Lake Reservoir is operated in conjunction with East Lake Reservoir, West Lake Reservoir, and other water storage facilities to supply municipal water to the City of Danbury. Surplus waters from East Lake Reservoir are transported into Margerie Lake Reservoir by gravity pipe for holdover storage.

h. Design and Construction History

No information was recovered regarding the design or construction of the main dam and dike. To the recollection of City of Danbury Utilities Department personnel, the project was constructed about 1933 as a Federal WPA project. It is therefore possible that detailed design drawings and specifications for the facility were never prepared.

1. Normal Operating Procedure

There are no written operating procedures. Operators are on duty around the clock at the filter plant near the reservoir and are available to periodically check the reservoir conditions. Outlet gate and valves at the dam are normally open and operation would not be a day-to-day procedure, if they are now operable (see Section 3).

1.3 Pertinent Data

a. Drainage Area

The drainage area contributing to the Margerie Reservoir is principally the area of the hillsides to each side and the reservoir area proper, which encompass a total of 806 acres or 1.26 sq. mi. The surface area of the lake at normal storage level is 244 acres or 30 percent of the total basin. The hillside rims of the drainage area rise to 200 ft. above the reservoir level in distances of from 1,000 to 2,000 ft. from the shoreline. Runoff from rainfall on the area adjoining the lake would be rapid, with but little surface infiltration. Disregarding spillway outflow, for a 19 in. PMP rainfall, if the lake level was full to spillway level at the start of the flood, the surcharge storage space would fill only to about a 5 ft. depth.

b. Discharge at Damsite

1. Outlet Works Conduit

Discharge at Margerie Reservoir is provided by a single 30-in. dia. pipe leading directly into the filter plant below the dam. No bypass is provided and releases cannot be made to the stream below the reservoir. Because of this, a drawdown of the reservoir below spillway level is not possible, except for that which can be passed through the plant. The intake was submerged during inspection and the invert elevation could not be determined.

2. Maximum Flood at Damsite

Since the Margerie Reservoir is constructed as an off-stream facility in an area which has a small inflow, no flows of consequence have been recorded.

3. Ungated Spillway Capacity

The spillway at Margerie Reservoir is an ungated chute with concrete sill control. The discharge capacity at head to top of dam is about 1,600 cfs. The capacity at estimated maximum flood surcharge level of 3.9 ft. is about 740 cfs.

c. Elevation (ft. above MSL)

1. Top of dam - 632.5
2. Maximum pool-design surcharge - 629.9
3. Spillway crest - 626.0
4. Diversion tunnel - none
5. Streambed at centerline of dam - 604

d. Reservoir

1. Length of pool - 8,600 ft.
2. Average width of pool - 1,200 ft.

e. Storage (acre-ft.)

1. At normal storage pool - 4,270
2. At design surcharge - 5,350
3. At top of dam - 6,100

f. Reservoir Surface (acres)

1. Top of dam - 308
2. Maximum surcharge pool - 290
3. Spillway crest - 244

g. Main Dam

1. Type - compacted earth embankment
2. Length - 735 ft.
3. Height - 28.5 ft.
4. Top width - 10 ft.
5. Side slopes $2\frac{1}{2}$ to 1 upstream; 2 to 1 downstream
6. Zoning - unknown
7. Cutoff - unknown
8. Grout curtain - none (assumed)

h. North Dike

1. Type - compacted earth embankment
2. Length - 1,104 ft.
3. Height - 16 ft.
4. Top width - 10 ft.
5. Side slopes - 2 to 1 upstream and downstream
6. Zoning - unknown
7. Cutoff - unknown
8. Grout curtain - unknown

i. Spillway

1. Type - unlined channel
2. Length of weir - 30.5 ft.
3. Crest elevation - 626.0
4. Ungated
5. Upstream channel - unlined, partly in rock cut, riprapped
6. Downstream channel - unlined, partly in rock cut, riprapped
7. General - 1.2 ft. high control sill at elevation 626.0

j. Regulating Outlets

1. Invert - not ascertained
2. Size - 30 in. dia. pipe
3. Control mechanism - 30" guard valve; 30" control valve
4. Other - control at filter plant by outlet valves, size not determined; releases not controlled by 30" valves at dam; no bypass outlet from 30" pipe

SECTION 2 - ENGINEERING DATA

2.1 Design

No data on the design of the dam or appurtenances has been recovered and probably none exist. In 1967, however, the City of Danbury had topographic maps at 100 ft. to the inch prepared by photogrammetric methods of the Margerie Lake area, which delineate the location and elevations of the dam and dike. In the course of the inspection, measurements were also taken of the structures and a plan and profile layout of Margerie Dam, dike and appurtenances has been prepared. These plans are shown on Figures 1 and 2 in Appendix B.

2.2 Construction

The project is said to have been constructed as a Federal WPA project about 1933. No records or correspondence regarding construction have been found.

2.3 Operation

The dam is operated by the City of Danbury, Department of Public Utilities. There appear to be no formal records other than reservoir levels.

2.4 Evaluation

a. Availability

Since no engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy

Without any engineering data, a definitive review and assessment of this dam is impossible. The evaluation is based primarily on visual inspection and engineering judgment.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Margerie Lake Reservoir Dam took place on 23 October 1978. The dam appears to be in a generally good condition. The north dike was observed and also appears to be in a generally good condition. There are a number of seepage points along the downstream toe of the dam embankment. Light brush covers the downstream slope and there is minor brush on the upstream slope. The gate valves in the outlet structure are left open permanently and may not be readily operable. There is no provision for a blowoff on the pipe between the outlet structure and the filter plant about 1,000 ft. south of the dam, where valves control the outflow from the reservoir.

b. Main Dam and North Dike

1. Main Dam

Margerie Lake Reservoir Dam has an embankment about 735 ft. long with a maximum height of 28.5 ft. and a crest width of 10 ft. The horizontal and vertical alignment of the embankment is good. The upstream slope protection is hand-placed rock riprap, which is in generally good condition (Appendix C, Photo No. 1). Some minor erosion in the area where the bridge from the intake structure intersects the crest of the dam has recently been filled with trap rock having a maximum size of 2 in. There is some minor brush growth above what appears to be normal storage level. At the right abutment, there is a large outcrop of granitic rock through which the spillway channel has been cut.

The downstream toe of the dam where the embankment slope intersects natural ground has a rock facing for a distance of about 10 ft. to 15 ft. along the slope, which extends eastwards from the right abutment for about 270 ft. The downstream slope appears to be quite stable with no evidence of bulges or slides, but there is a considerable amount of light brush growing on it (Appendix C, Photo No. 2). At the lowest point in the downstream toe, there is a wet area with some minor

seepage estimated at 1 to 2 gpm. Another wet area was noted 81 ft. left of the left wall of the outlet structure and about 50 ft. downstream of the centerline of the dam. This wet area is about 10 ft. by 20 ft. There appears to be a rock toe between the right abutment and this point, but it does not extend further towards the left abutment, as far as could be determined. The entire downstream toe is somewhat obscured by light tree and brush growth, which should be cleared to facilitate observations in the future. A third wet area was observed; however, this appears to be an accumulation of seepage rather than a single, well defined spring or boil. This area is about 15 ft. by 30 ft., beginning about 100 ft. to the right of the right wall of the outlet structure (Appendix B, Figure 1). Two small chuck holes (less than 12 in. dia.) were noted on the downstream slope about 40 ft. to the left of the spillway outlet channel training wall, 2 ft. and 4 ft. respectively from the crest of the dam, vertically. A motorcycle path was noted on the downstream slope of the dam, up to a foot deep, located about 100 ft. to the right of where the left end of the embankment intersects natural ground.

2. North Dike

The north dike has an embankment about 1,100 ft. long with a maximum height of about 16 ft. and a crest width of about 10 ft. There are no evidences of bulges, or horizontal or vertical movement, although the horizontal alignment is irregular (Appendix B, Figure 2). The upstream slope protection consists of dumped and hand-placed riprap (Appendix C, Photo No. 3). Some riprap is missing in an area adjacent to an earth ramp near the center of the dike. The upper part of the upstream slope, crest and downstream slope are all covered with light brush growth (Appendix C, Photo No. 4). There is a drainage ditch along the downstream toe of the dike which takes runoff from the shopping center development immediately downstream from the dike, which was dry at the time of the inspection. There is a manhole on the downstream slope located about 150 ft. to 200 ft. right of the left abutment. The water level was measured at 13 ft. below the rim, or about 13 ft. below the reservoir level, indicating that the water is probably seepage and the manhole is probably connected to a toe drain. There is an outlet pipe on the north side of Highway 39 located immediately north of the dike and

across the street from the Post Office. At the time of the inspection the flow was about 100 gpm with the water running clear. It is assumed that this was discharge from a toe drain.

c. Appurtenant Structures

1. Spillway

The spillway at the right abutment consists of a 30 ft. wide channel cut through the rock, across which a concrete control sill has been built (Appendix C, Photo No. 5). The unlined channel cut to a depth of 1.2 ft. below spillway level was found to be in generally good condition, with hand-placed rock riprap in the bottom and side slopes. A 75 ft. long concrete retaining and guide wall has been built on the left side of the spillway outlet channel. The concrete appears to be in good condition with some superficial spalling. There is some minor tree and brush growth in the outlet channel about 200 ft. downstream from the spillway, including one tree 12 in. in circumference (Appendix C, Photo No. 6). A wet area was noted at the junction of the spillway outlet channel and natural ground, about 250 ft. downstream from the spillway crest. This wet spot probably results from seepage from the reservoir into the spillway outlet channel.

2. Outlet Structure

The outlet structure is a 30 in. dia. pipe. A concrete shaft, located about 20 ft. upstream of the dam crest and about 270 ft. from the left side of the spillway, contains the two control gate valves. The concrete is in generally good condition, with some hairline cracks and minor spalling noted. The inlet could not be observed and the outlet is a buried pipe. Both gates are left in the open position on a more or less permanent basis and it is doubtful whether they could be closed without difficulty.

d. Reservoir Area

An inspection of the reservoir shoreline revealed no evidence of sloughing or erosion.

e. Downstream Channel

The downstream channel is wooded and overgrown. There is a culvert under the access road which crosses the channel. There was no evidence that water has ever discharged over the spillway, but water stains on the outlet tower indicate that at times the water has reached normal storage level.

3.2 Evaluation

The visual inspection of the dam revealed sufficient information to permit an assessment of those features affecting the safety and stability of the structure to be made. The dam and appurtenant works are judged to be in good condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Margerie Lake Reservoir facility is operated by personnel of the Danbury Public Utilities Department, who are stationed at the filter plant about 1,000 ft. below the dam. Reservoir operation entails mainly the release of stored water from the reservoir as water supply needs warrant. The outlet from the reservoir to the filter plant is a pressure pipe with valves at the outlet of the pipe, such that day-to-day regulation of the outlet valves is not required and, indeed, they are left open permanently. No documented operating procedures have been prepared.

4.2 Maintenance of Dam and Dike

At the main dam and north dike, little maintenance is required except for periodic cutting of brush growth on the embankments. No documented maintenance instructions have been prepared.

4.3 Maintenance of Operating Facilities

The gate valve operating mechanisms require periodic maintenance to keep them serviceable.

4.4 Warning System

No warning system is in effect at this dam.

4.5 Evaluation

Although little is known about the construction of the facility, it has simple operating devices and, as such, requires no detailed operating procedures. Maintenance involves periodic growth removal from the embankments and surveillance regarding seeps, slope damage, animal burrows, etc. Outlet operating valves require checking for serviceability. A formal warning and emergency evacuation system should be developed.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

1. Area-Capacity Curves for Reservoir

It is believed that the Margerie Lake Reservoir is an enlargement of a small lake which formerly occupied the area, such that some inactive storage below the level of the foundation of the dam is contained in the lake. The reported active capacity of the reservoir is 4,297 acre-ft. to the level of the spillway crest. Surcharge capacity above the normal storage has been computed from planimetered areas of the contours delineated on the USGS 7.5 minute series quadrangle sheets. A reservoir area-capacity curve is shown on Figure 3 in Appendix D, page D-1.

2. Test Flood

The test flood chosen to evaluate the hydrologic and hydraulic capacity of Margerie Lake Reservoir Dam was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as intermediate in size with a high hazard potential, a test flood of a magnitude corresponding to the full Probable Maximum Flood was selected for the evaluation.

3. Flood Hydrology

For the purpose of determining potential runoff from the 806 acre drainage area, an inflow flood hydrograph was prepared to serve as the test flood for evaluating the hydraulic criteria of the design. Precipitation data was obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.3 in. of point rainfall over a 10 sq. mile area. This value was reduced by 20 percent to allow for basin size, shape and fit factor. The 6 hour rainfall-duration curve of 19.2 in. was then distributed and rearranged as suggested in Design of Small Dams, from which an inflow hydrograph was prepared, assuming only a short lag period unitgraph because of the rapid runoff in the

confined basin. The inflow hydrograph shows an inflow peak of about 11,000 cfs. occurring about 3½ hours after the start of the flood event. The hydrograph is shown on Figure 4 in Appendix D, page D-4.

Routing the above PMP hydrograph inflow flood through the reservoir and spillway results in a maximum spillway outflow of about 740 cfs. at reservoir elevation 629.9 or with a remaining freeboard of 2.6 ft. to top of dam. It is thus apparent that overtopping the dam from a PMP flood event would not be possible (Appendix D, Figure 4, page D-4).

b. Experience Data

No information is available with respect to past operation of the reservoir nor are there any records of the occurrence of spills.

c. Visual Observations

From a cursory examination for scouring at the unlined chute of the spillway, no evidences that the spillway had operated were observed. The reservoir at the time of the inspection was at about elevation 622.5; stain marks on the dam riprap and outlet tower show that the reservoir has been at times up to normal storage level.

d. Overtopping Potential

As noted in Section 5.1a, the maximum surcharge head resulting from a routing of a PMF would reach 3.9 ft., leaving a freeboard to top of dam and dike of about 2.6 ft. On this basis, the threat of an overtopping of the dam owing to a Probable Maximum Flood event would not materialize.

e. Drawdown Capacity

There is no provision for drawdown of the reservoir except by means of withdrawals through the filter plant. These withdrawals are small compared to the amount of storage below spillway crest level and would have but very little effect if need for a rapid evacuation of the reservoir was required. Rapid drawdown could be carried out only by a controlled breaching of the spillway or of the dam.

f. Downstream Hazard Potential

Breaching of the dam or dike by overtopping is not a likelihood, as noted in Section 5.1a, but a breach because of structural failure of the dam or dike by piping or sloughing could conceivably occur. A breach from that cause would be similar to that from an overtopping and the "rule of thumb" criteria suggested in the NED March 1978 Guidance Report would be applicable, except that the reservoir at such a time would be somewhat lower than to the top of the dam. Since such weaknesses usually show up after prolonged periods of precipitation when the embankment slopes would become saturated or when somewhat higher than normal loadings from reservoir storage raise the phreatic line in the dam, it could be assumed that failure might occur at about half the surcharge head for a PMF. In this instance a reservoir surface at about 627.5 at breach failure time might be considered applicable for analysis purposes.

Assuming a 100 ft. breach width at the main dam, a flood surge of about 12,000 cfs. could be released from the reservoir. On this basis, plotted on Figure 5 are curves showing discharges and reservoir elevations versus emptying time (Appendix D, page D-5).

At the north dike, although the downstream toe of the embankment is as much as 10 ft. below normal storage level, the area downstream from the dike where the highway is located is much higher, being at a level above average storage in the reservoir for a good portion of the area. As indicated on the profile on Figure 2, only for about 300 ft. along the highway is the level below elevation 626, where the highway profile dips to about elevation 624. If this highway reach forms a control, only about 1,000 cfs. could be released if the dike failed, assuming the reservoir was at normal storage level when the breach occurred. The Post Office below the dike and about five homes across the road below the athletic field would be the main facilities affected.

There are now a number of homes and commercial establishments along State Highway 37 which follow Padanaram Brook below Margerie Lake Reservoir. Stage-discharge computations show that a flood depth of up to 15 ft. would prevail for an 11,000 cfs. discharge down the brook. From Figure 5 it can be seen that a 100 ft. wide breach at Margerie Lake Dam could release that magnitude discharge, and that only

15 minutes of outflow would be needed to fill the entire reach of the Padanaram Brook valley to the 15 ft. stage. At least 25 homes, a number of roadside commercial establishments, part of the Abbott Technical School and Route 37 itself would be affected. It is probable that more densely populated areas of Danbury south of Interstate Route 84 would also be affected. During the inspection it was noted that foundations for a number of new homes in a housing development were being built practically at stream level on both banks of the stream along Highway 37 and Padanaram Road below the Margerie Lake Reservoir. These and any future new homes in the vicinity would also be affected. Delineated on Figure 6 (quad sheet graphic) are the areas which could be flooded by a breach failure of either the main dam or the north dike (Appendix D, page D-8).

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The field investigations of the main dam earth embankment and north dike revealed no significant displacements or distress which would warrant the preparation of slope stability computations based on assumed soil properties and engineering factors. Data on the design and construction of the south dam and north dike could not be obtained. Both the main dam embankment and the north dike appear to be in good condition.

b. Design and Construction Data

"As built" plans for the dam and dike are not available. Since shear strength data of the embankment material and foundation were not available, and since details of dike and dam construction are not available, a detailed stability analysis is not deemed worthwhile.

c. Operating Records

The level of water in the reservoir is recorded by the operators of the filter plant.

d. Post Construction Changes

The results of the field inspection and a check of the available records produced no evidence of changes which might impair stability of the dam or dike. However, as stated, no design or construction drawings were available.

e. Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with recommended Phase I guidelines, does not warrant seismic analyses.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the Phase I visual examination, the main dam and north dike appear to be in good condition and functioning adequately. The deficiencies revealed are not of major concern, but tend to indicate that a small amount of additional routine maintenance is required. The two outlet control gates are left open permanently and their serviceability is doubtful. The reservoir cannot be drawn down rapidly because there is no blowoff on the 30 in. dia. outlet pipe to the filter plant. The spillway capacity is adequate to pass the test flood outflow without overtopping the dam.

b. Adequacy of Information

The information recovered is considered adequate for the purpose of making an assessment of the performance of the dam.

c. Urgency

The recommendations and remedial measures enumerated below should be implemented by the owner within two years after receipt of the Phase I Inspection Report.

d. Need for Additional Investigation

The visual inspection identified two potential problems which require additional investigation. These are:

- 1) lack of means for rapid drawdown of the reservoir, and,
- 2) outlet control gates which may be difficult to operate.

7.2 Recommendations

It is recommended that the owner should retain the services of a competent registered professional engineer to make investigations, studies and, if proved necessary, design a suitable means of rapid drawdown for the reservoir. Two possibilities are:

- 1) provision of a blowoff on the existing 30 in. dia. outlet pipe, or
- 2) provision of a separate new outlet facility.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Brush growth on both the main dam and north dike should be cut on a regular basis.
2. Seepage at the downstream toe of the main dam should be monitored for quantity and clarity periodically during periods of high reservoir level and at least once a year. Seepage entering the toe drain manhole located on the downstream slope of the north dike should also be monitored on the same basis.
3. Two small chuckholes in the main dam approximately 40 ft. left of the spillway left training wall should be filled.
4. Riprap missing on the upstream slope of the north dike should be replaced in the area adjacent to the earth ramp near the center of the dike.
5. The 30 in. dia. outlet gate valves should be tested to determine whether they function properly and, if necessary, put into good working order.
6. The owner should develop a formal flood warning system. An operational procedure to follow in the event of an emergency should also be adopted.

7.4 Alternatives

There are no practical alternatives to the above recommendations.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

Identification No. CT00063

Name of Dam: Margerie Lake Reservoir

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
<u>EMBANKMENT</u>	
Vertical alignment and movement	No movement evident at main dam or dike.
Horizontal alignment and movement	No movement evident at main dam or dike. Dike alignment is far from straight.
Unusual movement or cracking at or near the toe	None evident at dam or dike.
Surface cracks	None evident.
Animal burrows and tree growth	No burrows observed. Brush growth on main dam and dike.
Sloughing or erosion of slopes	None evident.
Riprap slope protection	Good condition.

VISUAL INSPECTION CHECKLIST

Identification No. CT00063 Name of Dam: Margerie Lake Reservoir Sheet 2

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

Seepage Three locations at downstream toe of main dam as noted on Figure 1.

Piping or boils

None evident.

Junction of embankment and abutment, spillway and dam

Minor displacement of riprap on U/S slope at left training wall of spillway.

Foundation drainage

10 ft. rock slope along D/S toe of main dam.

OUTLET WORKS

Approach channel

None.

Outlet conduit concrete surfaces

None.

Intake structure

Concrete tower has minor cracks and spalling. Intake not visible.

Outlet structure

None (buried 30 in. dia. pipe).

VISUAL INSPECTION CHECKLIST

Identification No. CT00063 Name of Dam: Margerie Lake Reservoir Sheet 3

VISUAL EXAMINATION OF

OBSERVATIONS AND REMARKS

Outlet channel Seepage at end of channel 250 ft. \pm from spillway.

Drawdown facilities

Two 30 in. dia. gate valves, manual operation.
Left open, condition doubtful.

SPILLWAY STRUCTURES

Concrete weir

2 ft. wide, 1.2 ft. high sill in rock channel,
condition good.

Approach channel

Cut in rock, riprap floor in fair condition,
some brush growth.

Discharge channel

Cut in rock to natural valley. Riprap for
185 ft. Some brush.

Stilling basin

First 63 ft. of outlet channel is level.

Bridge and piers

None.

Control gates and operating machinery

None.

VISUAL INSPECTION CHECKLIST

Identification No. CT00063 Name of Dam: Margerie Lake Reservoir Sheet 4

VISUAL EXAMINATION OF	OBSERVATIONS AND REMARKS
<u>INSTRUMENTATION</u>	
Headwater and tailwater gages	None.
Embankment instrumentation	None.
Other instrumentation	None.
<u>RESERVOIR</u>	
Shoreline	Gentle slopes, trees and woods, appear stable.
Sedimentation	None evident.
Upstream hazard areas in event of backflooding	Not applicable - off stream.
Alterations to water shed affecting runoff	None noted.

VISUAL INSPECTION CHECKLIST

Identification No. CT00063 Name of Dam: Margerie Lake Reservoir Sheet 5

VISUAL EXAMINATION OF OBSERVATIONS AND REMARKS

DOWNSTREAM CHANNEL

Constraints on operation of dam

None.

Valley section

Wide valley immediately D/S.

Slopes

Gentle slopes immediately D/S.

Approx. No. of homes/population

At least 25 homes and some commercial establishments along Pembroke and Pandanaram Roads. New homes under construction on banks of Pandanaram Brook.

OPERATION & MAINTENANCE FEATURES

Reservoir regulation plan, normal conditions

No formal plan. Water released as required.

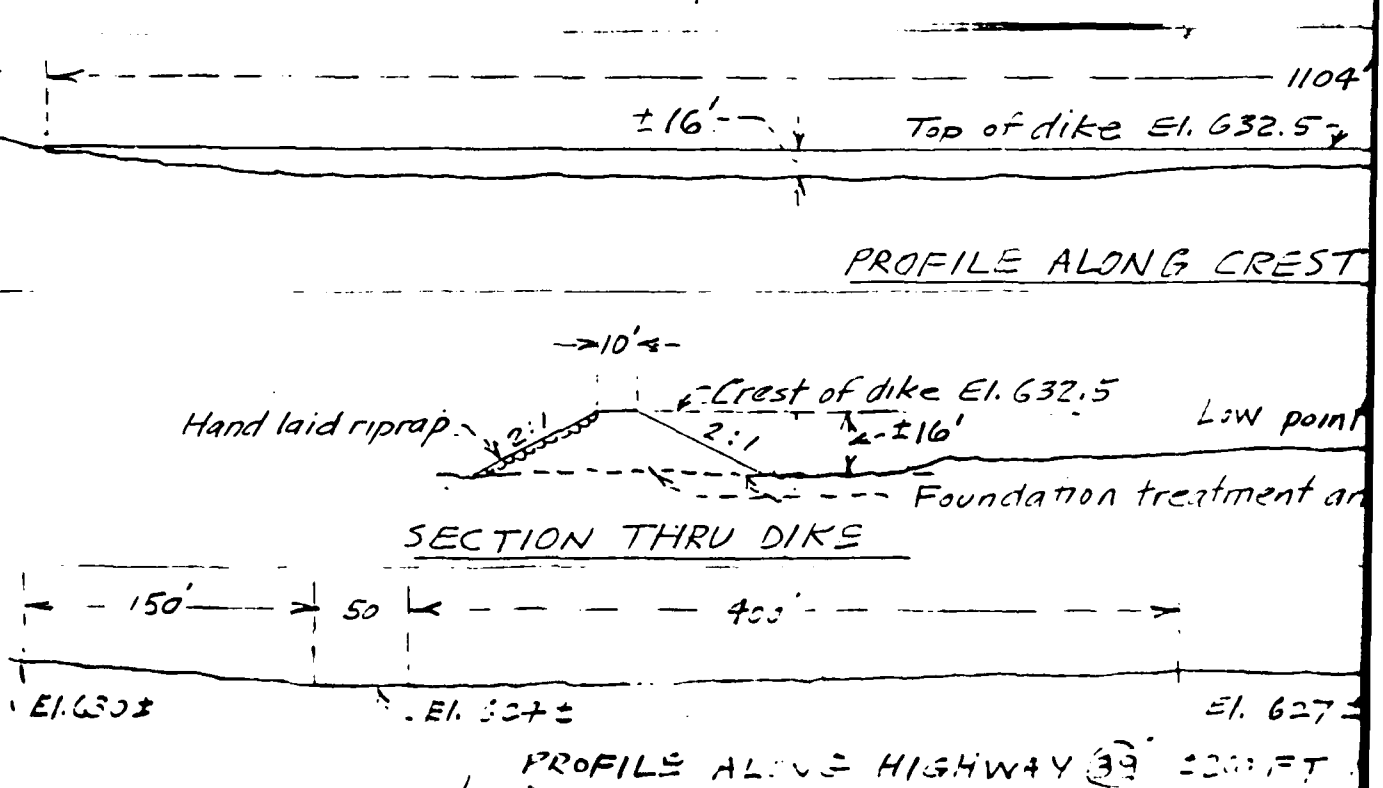
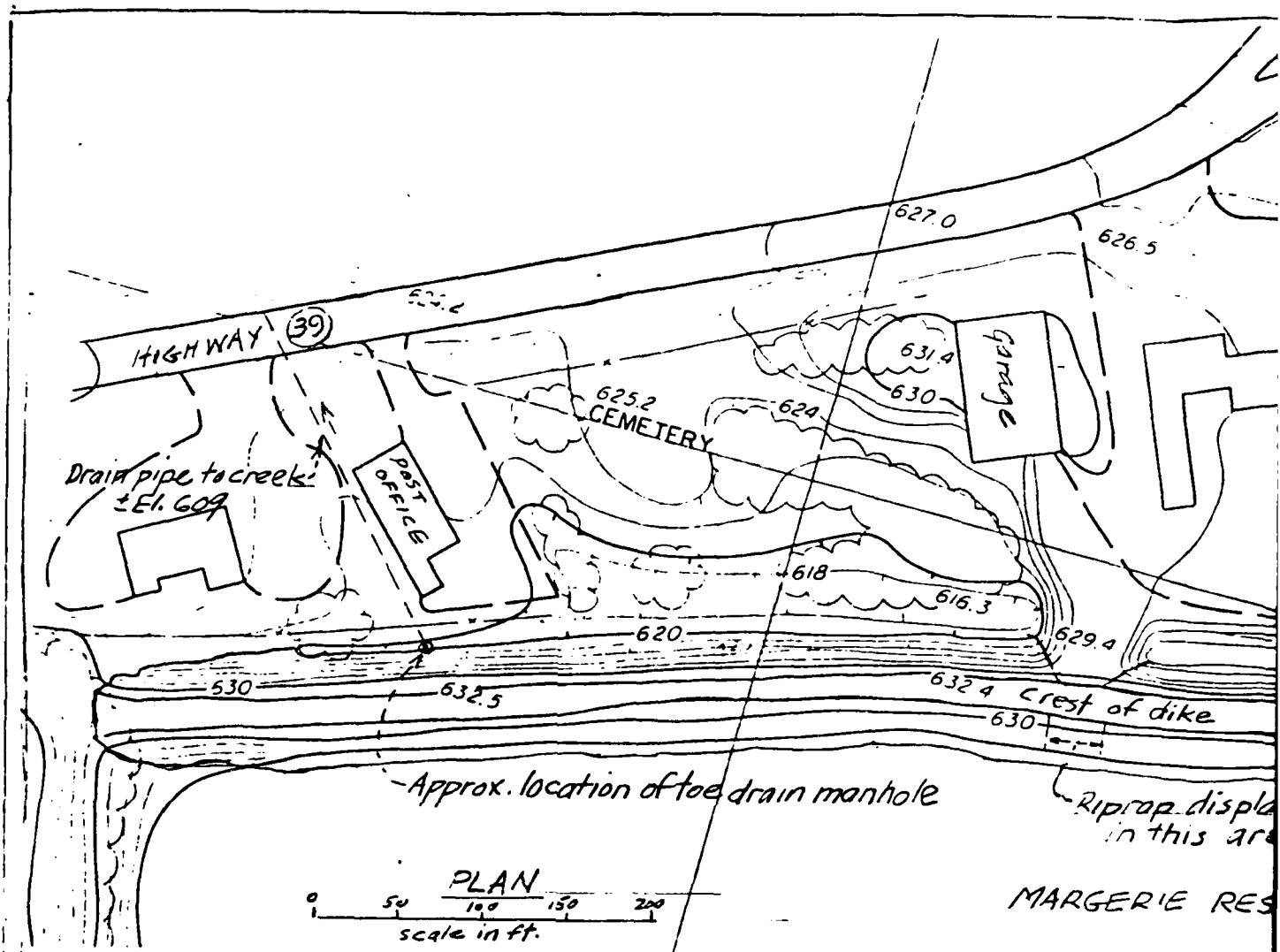
Reservation regulation plan, emergency conditions

None.

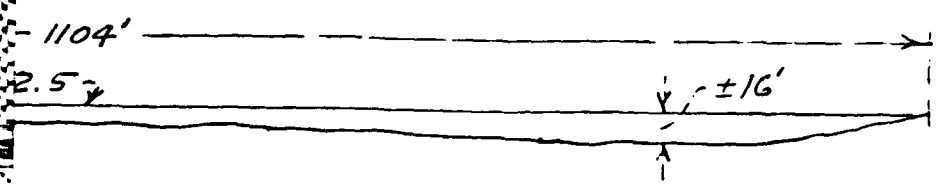
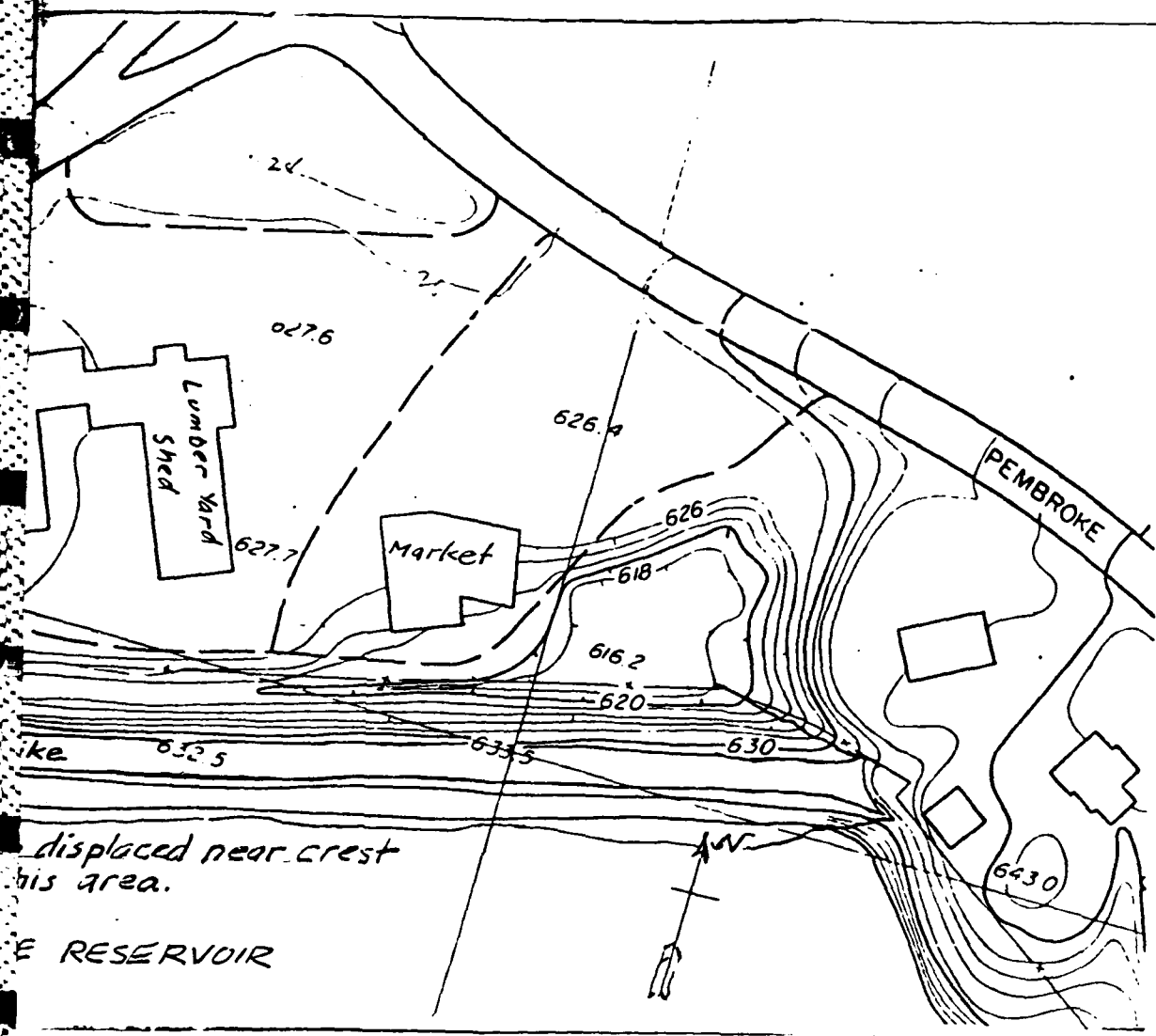
Maintenance features

Brush cut periodically.

APPENDIX B
PLANS & RECORDS



PROFILE ALONG HIGHWAY 39 200 FT.



CREST OF DIKE

point \pm El. 624' - Highway
 vent and drainage unknown.

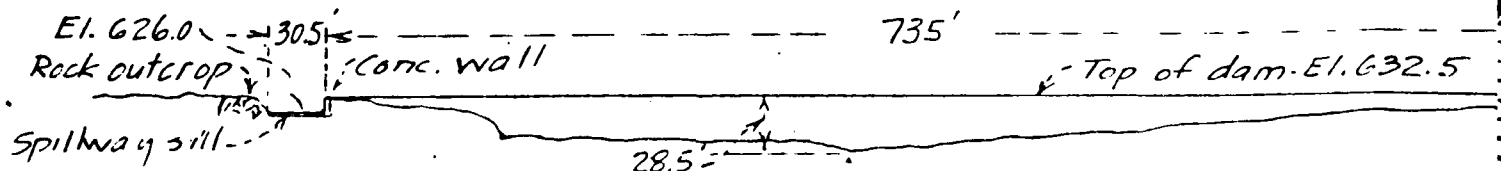
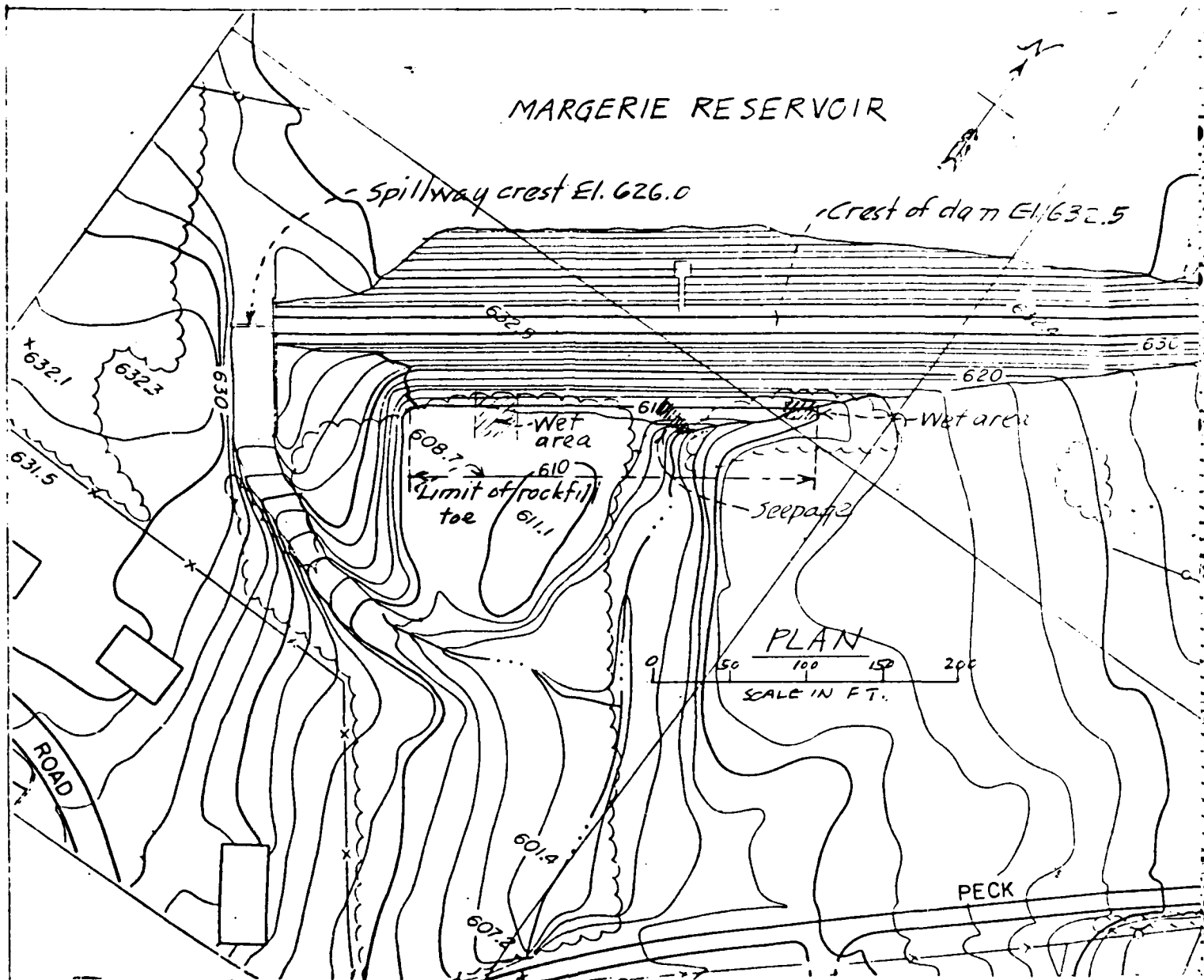
627 \pm -
10 FT. NORTH OF DIKE

CITY OF DANBURY CONN. -
 MARGERIE RESERVOIR
 NORTH DIKE - PLAN AND SECTION

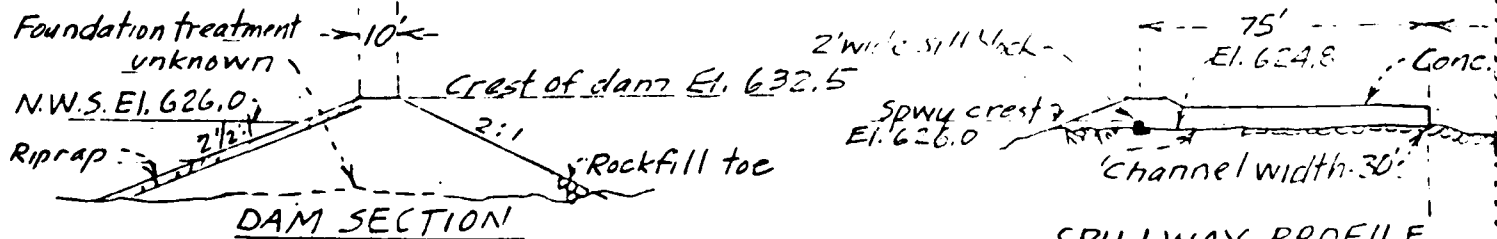
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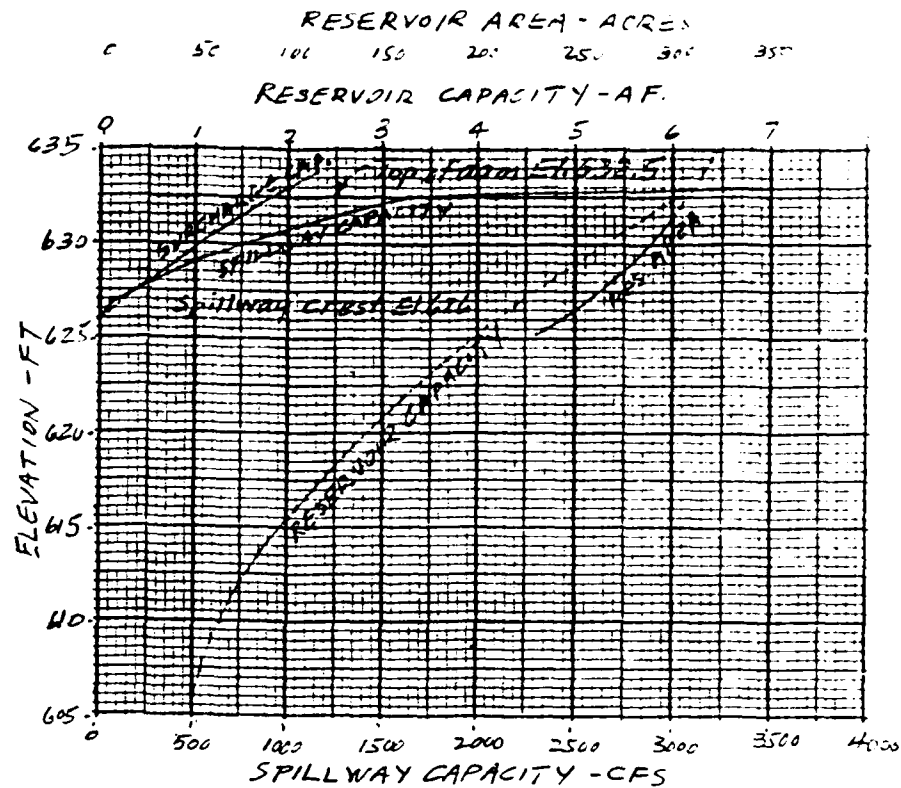
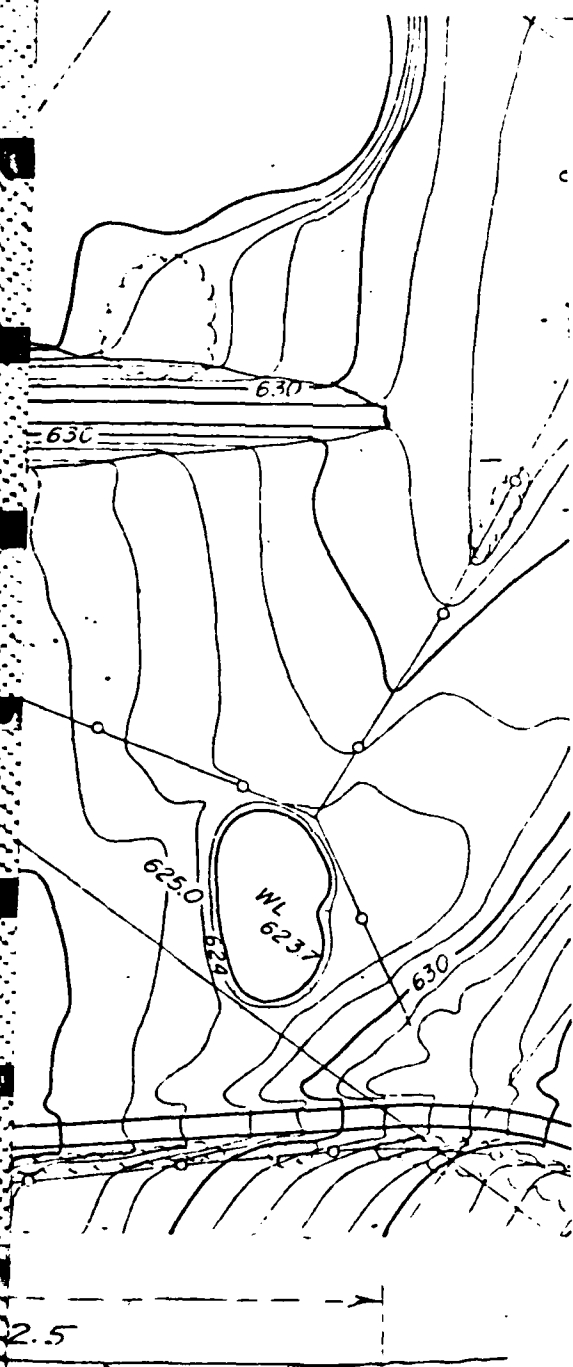
FIGURE 2

MARGERIE RESERVOIR

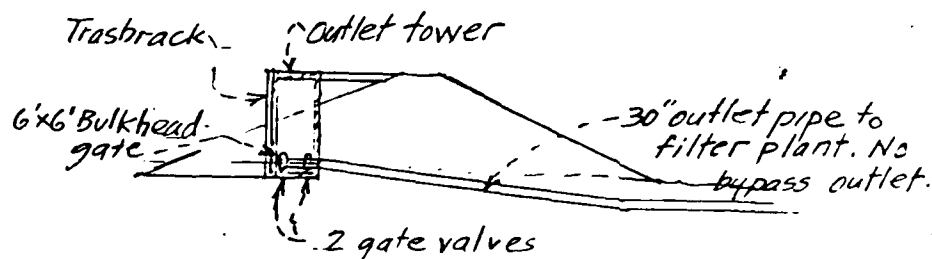


PROFILE ALONG CREST OF DAM





AREA-CAPACITY CURVES



PROFILE THRU OUTLET STRUCTURE

60' ---
 Conc. training wall-left side only.
 $S = \pm 0.15\%$ Channel width - 18'

CITY OF DANBURY, CONN
 MARGERIE RESERVOIR
 MAIN DAM-PLAN AND PROFILES

FIGURE .1

APPENDIX C
SELECTED PHOTOGRAPHS

MARGERIE LAKE RESERVOIR DAM



1. Upstream slope and outlet shaft from left abutment of main dam.



2. Downstream slope from crest of dam near outlet structure.

MARGERIE LAKE RESERVOIR DAM



3. Upstream slope of north dike from right abutment.



4. Downstream slope of north dike from right abutment.

MARGERIE LAKE RESERVOIR DAM



5. Concrete sill in spillway and left training wall.



6. Spillway outlet channel looking towards spillway from 250 ft. downstream.

APPENDIX D

HYDRAULIC & HYDROLOGIC COMPUTATIONS

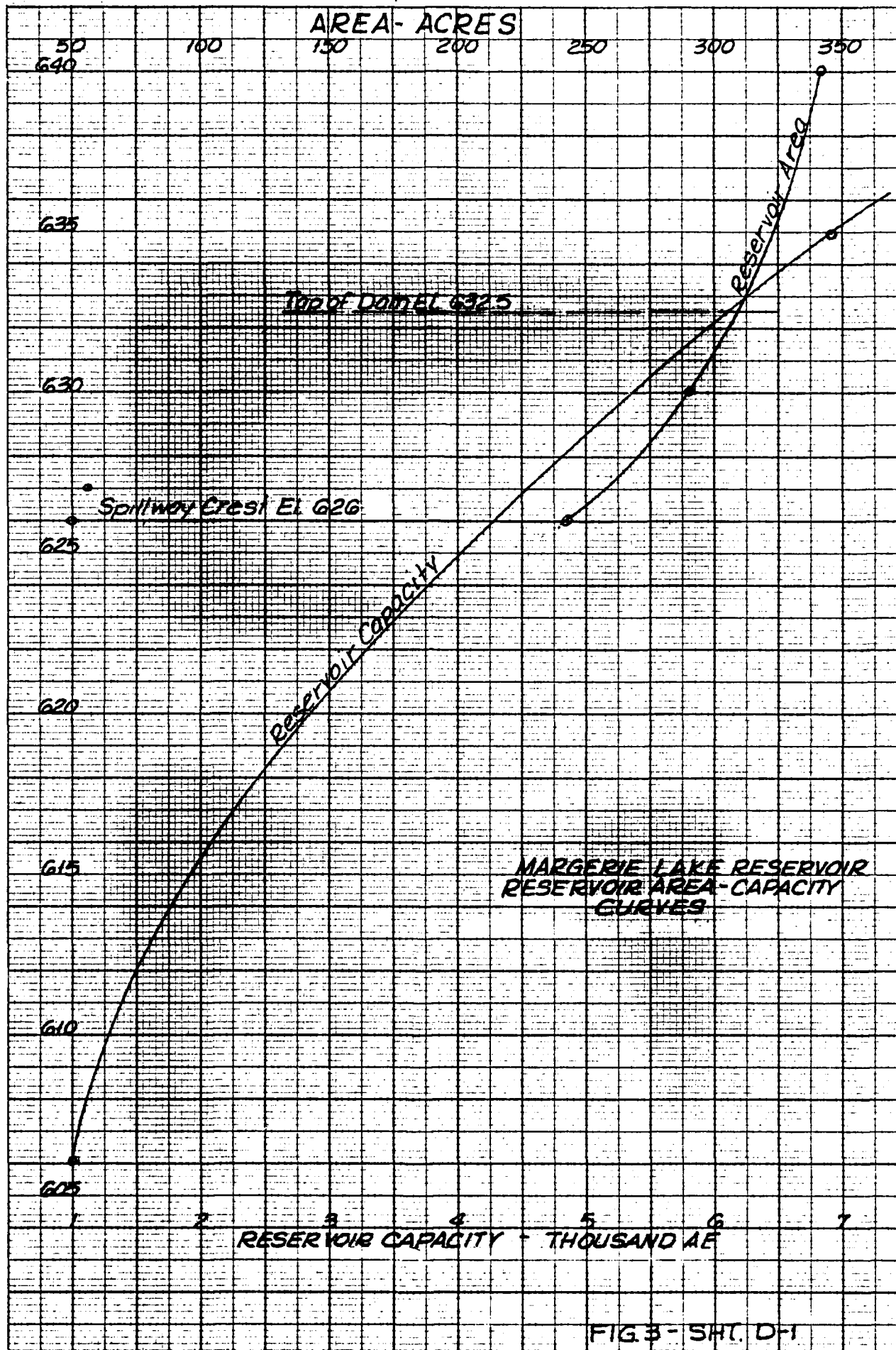


FIG. 3 - SHT. D-1

BY R.H. DATE 10/20/78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____

INSPECTION OF DAYS - Conn. RI.

PROJECT _____

SUBJECT MARGERIE RESERVOIRAREA - CAPACITY CURVES

Elev.	Area acres	Ave. area A325	H ⁺	4 Stor	5 Storage	Surcharge Storage
606	0					
610			4			
615			5			
620			5			
626	244		6		4297	0
627	257	250.5	1	250	4547	250
628	270	263.5	1	264	4811	514
629	283	276.5	1	276	5087	790
630	290	286.5	1	287	5374	1077
631	298	294	1	294	5668	1371
632	305	301.5	1	301	5969	1672
633	312	307.5	1	308	6277	1980
634	318	315	1	315	6592	2295
635	323	320.5	1	320	6912	2615
640	342	332.5	5	1665		4280

SPILLWAY DISCHARGE

Crest Elev. 626.0 L = 30.5'

Elev	H	C	ΔQ	H	C	ΔQ	Elev
626	0						0
627	1	3.1	95				95
628	2	3.12	269				269
629	3	3.14	498				498
630	4	3.16	771				771
631	5	3.18	1084				1084
632	6	3.2	1434				1434
632.5	6.5	3.22	1628	0	0		1628
633	7	3.24	1830	0.5	2.8	1840	3670
634	8	3.26	2250	1.5	2.9	9904	12154

BY LB DATE 12-27-78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ INSPECTION OF DAMS - Cont. RI

PROJECT _____

SUBJECT MARGERIE RESERVOIR DAMS - HYDROLOGIC and HYDRAULIC DATAMARGERIE RES. SOUTH DAM

Top of Dam Elev. 632.5 Toe of dam Elev. 612, Ht. $\pm 20'$
Spillway crest Elev 626.0 Length 30.5'

Drainage area 806 acres = 1.26 sq mi.
Reservoir capacity @ El. 626 - 4297 A.F.
Reservoir area @ El. 626 - 244 acres.
Length of dam 735'

MARGERIE RES. NORTH DAM

No Spillway Height of dike $\pm 16'$
Length of dam 1124'

Elev.	H	Reservoir	Spillway	Remarks
		Surcharge Storage A.F.	Discharge cfs	
626	0	0	0	Spillway crest
627	1	250	95	
628	2	514	269	
629	3	790	498	
630	4	1077	771	
631	5	1371	1084	
632	6	1672	1434	Top of dams.
632.5	6.5	1826	1628	
633	7	1980	3670	
634	8	2295	12,154	

FIGURE 4

KEITHLEY & ESSER CO
MADE IN U.S.A.

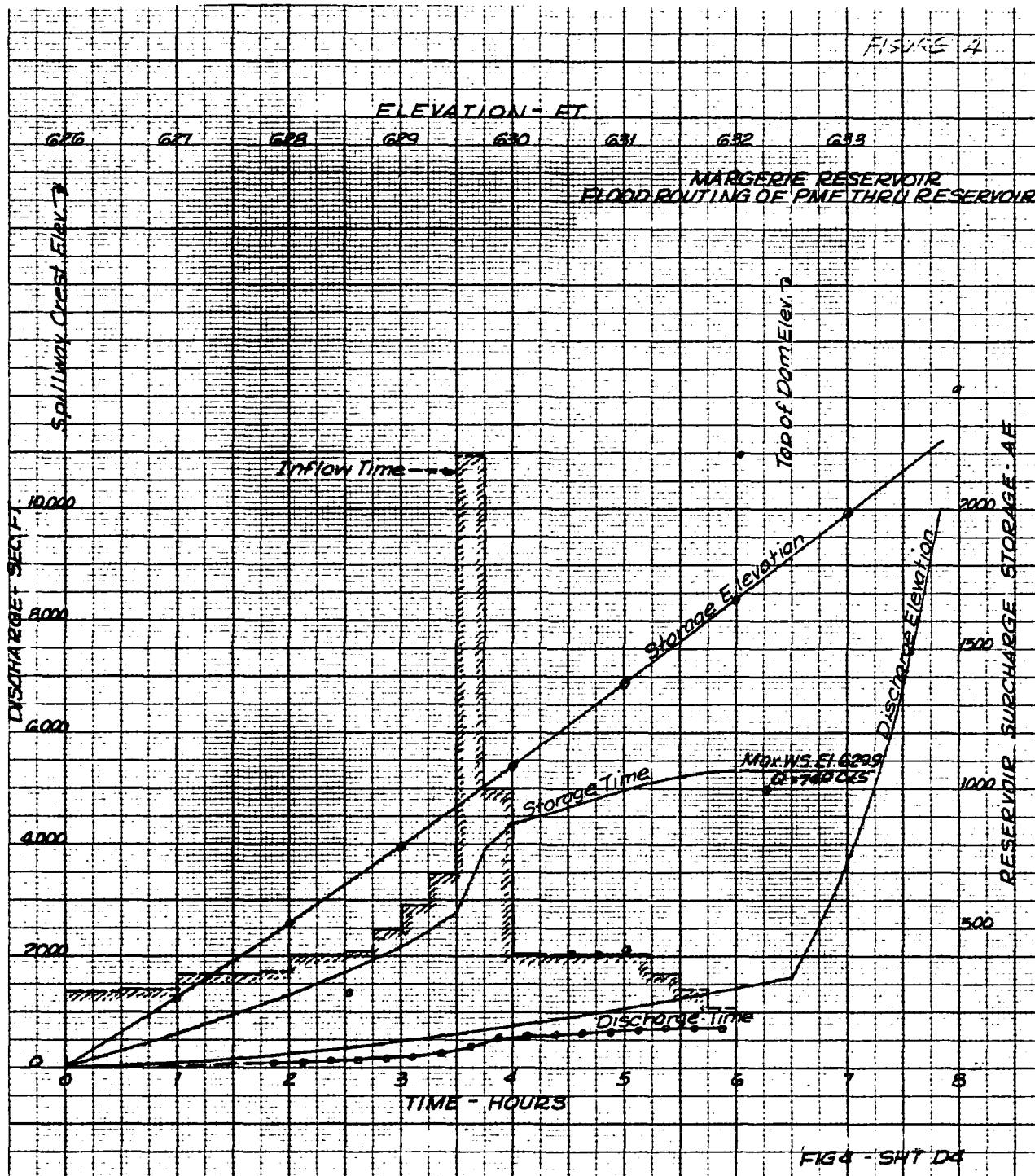


FIG 4 - SHT D4

BY 295 DATE 1-29-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 4-A OF

CHKD. BY _____ DATE _____ INSPECTION OF DAMS

PROJECT _____

SUBJECT MARSH LAKE DAM, YDR-0094

DRAINAGE AREA 1.26 sq mi = 806 acres - all from hillsides

Runoff area 244 acres

$$\frac{244}{806} = 30\%$$

 Rainfall 23.0"
 Reduction for 5% = 18.4"
 No reduction for
 Infiltration

Assume instantaneous runoff over entire D.A.

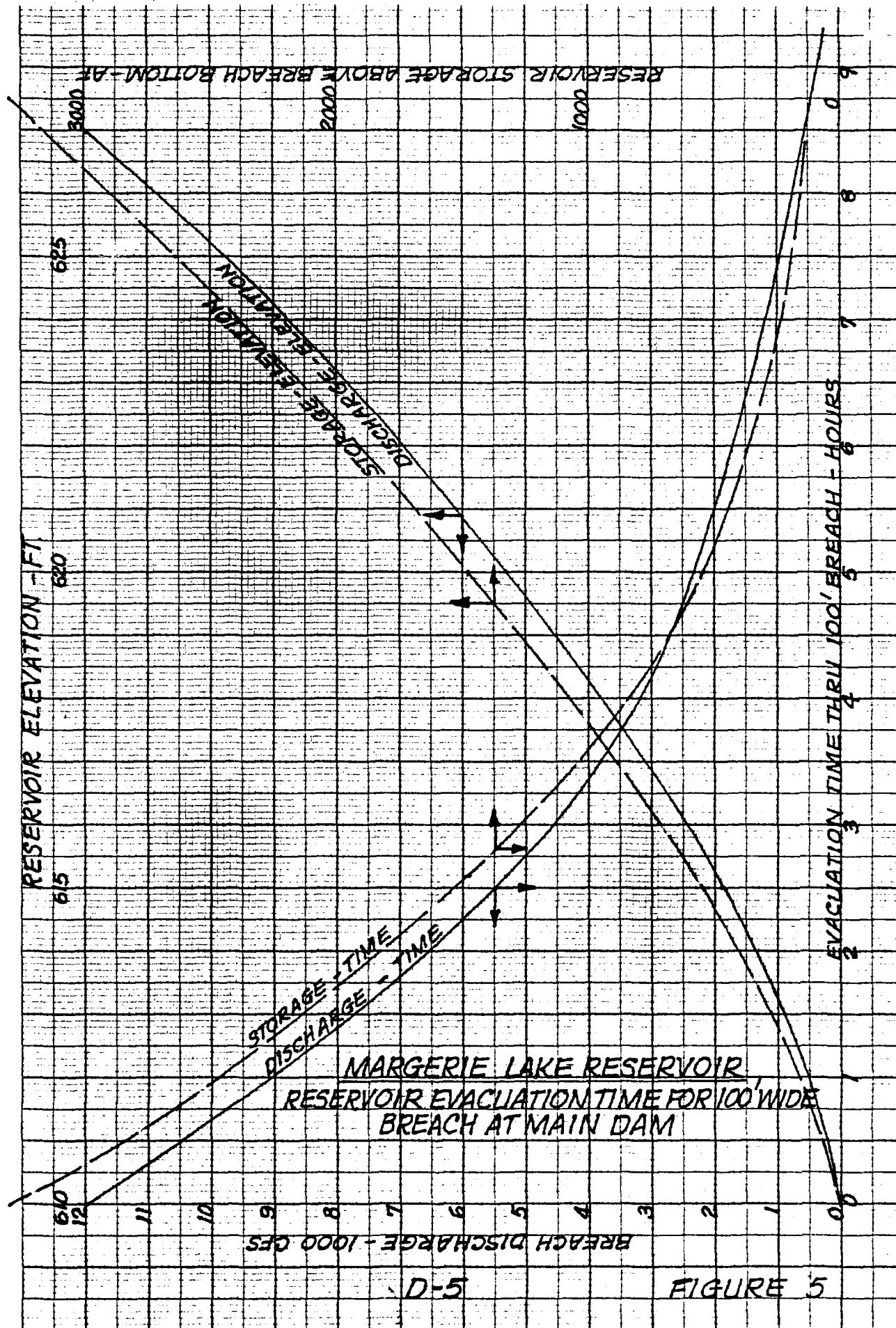
Time interval 15 minutes

$$\text{Runoff} = 645.3 \text{ cfs/hr/inch of precip} = 2581 \text{ cfs sq mi/inch of precip}$$

$$\text{For } 1.26 \text{ sq mi} = 3252$$

Time	Hour	Precip.	Δ Precip"	Rearrange 643.125 Precip.-inch	Runoff cfs
1.0	0.25	18.4	3.37	0.42	1360
2.0	0.50	26.8	4.91	0.42	1360
3.0	0.75	32.6	5.98	0.43	1400
4.0	1.00	37.5	6.87	0.43	1400
5.0	1.25	40.9	7.50	0.52	1690
6.0	1.50	44.3	8.13	0.52	1690
7.0	1.75	47.7	8.76	0.52	1690
8.0	2.00	51.1	9.39	0.53	1730
9.0	2.25	55.3	10.15	0.62	2020
10.0	2.50	58.8	10.80	0.62	2020
11.0	2.75	62.2	11.42	0.65	2080
12.0	3.00	65.6	12.04	0.76	2480
13.0	3.25	68.5	12.57	0.89	2900
14.0	3.50	71.3	13.09	1.07	3480
15.0	3.75	74.2	13.61	3.37	10960
16.0	4.00	77.0	14.13	1.54	5000
17.0	4.25	80.4	14.76	0.63	2040
18.0	4.50	83.9	15.39	0.63	2040
19.0	4.75	87.3	16.02	0.63	2040
20.0	5.00	90.7	16.65	0.63	2040
21.0	5.25	93.1	17.08	0.63	2040
22.0	5.50	95.4	17.51	0.52	1690
23.0	5.75	97.7	17.93	0.44	1410
24.0	6.00	100	18.35	0.33	1090
			18.35		

Plotted on Sheet D-4



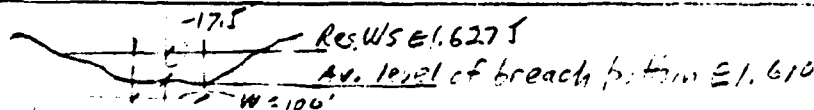
BY 12 DATE 12-9-78

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ INSPECTION OF DAMS - CONAT P.L.

PROJECT _____

SUBJECT MARSH LAKE DAM - BREACH ROUTING
EVACUATION OF RESERVOIR THRU 100' breach at Main dam.


$$\text{Max } Q = 1.68 W H^{3/2} = 1.68 \times 100 \times 17.5^{3/2} = 12000 \text{ cfs}$$

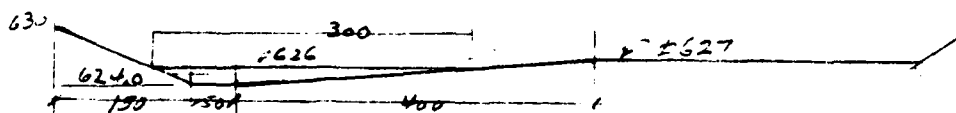
Res Elev.	H	Q	CF Average Q	AF Average outflow in 60 min	Storage in Res AF	Δ time to release storage hrs	Σ time from start to Δt + Δt _{res}	Res Storage AF	Outflow min AF
627.5	17.5	12000					0	3295	
625	15	9760	10880	898	670	0.75	0.75	2625	14.9
620	10	5300	7530	621	1150	1.85	2.60	1475	10.4
615	5	1880	3570	296	925	3.13	5.73	550	4.4
610	0	0	940	78	550	7.05	12.78	-	1.3

BREACH AT NORTH DIKE

ASSUME 50' width to E1 ± 616 WS @ EL 627.5 H = 11.5'

$$Q = 1.68 \times 50 \times 11.5^{3/2} = 3300 \text{ cfs}$$

IF control is at highway 200' downstream from dike


Critical flow with $d_c = 2.0'$ Top width ± 300' WS EL 626.0

$$A = \frac{300 + 50}{2} \times 2 = 350 \text{ ft}^2$$

$$\text{critical flow} - \frac{Q^2}{g} = \frac{A^3}{T} \quad Q_c = \frac{350^2 \times 32.2}{300} = 2145 \text{ cfs}$$

$$v_c = \frac{2145}{350} = 6.13 \quad h_{vc} = 0.58 \quad \text{Gradient} = \text{EL } 626.6$$

Loss to control = $1.0 h_c = 0.58$
Res WS. 627.2

Critical flow with $d_c = 1.0'$ Top width ± 210' WS EL 625

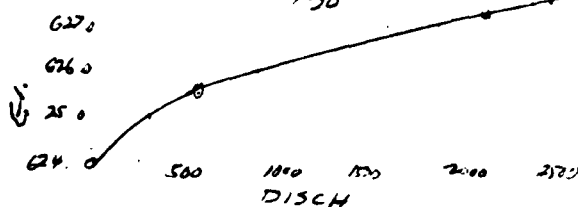
$$A = \frac{210 + 50}{2} \times 1 = 130 \text{ ft}^2$$

$$\text{Critical flow} \quad Q_c = \frac{130^2 \times 32.2}{210} = 580 \text{ cfs}$$

$$v_c = \frac{580}{130} = 4.46 \quad h_{vc} = 0.31$$

$$\text{Gradient} = \frac{625.0}{0.31} = 2032.3$$

Loss Res. to Control = $h_c = 0.31$
Res. W.S. 625.6



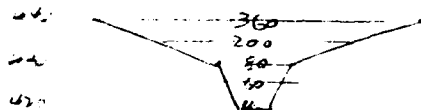
EVACUATION OF RESERVOIR THRU BREACH AT NORTH DILE

WS @ 627.5 at time of breach. Outflow control: 1st = 31.22, 2nd = 11.21

Elev.	Q over Highway	Q thru Spillway	Average Q - CFS	Volume (AF)	Stage (ft)	Area (sq ft)	Time (min)	Res. Storage (AF)	2nd Stage (min)
627.5	2400	175	-	AF	-	913		940	
627	1900	95	2285	3.14	145	46	0.77	795	3.15
626	900	0	1448	1.79	285	143	3.15	510	1.79
625	300		600	0.83	280	337	8.77	240	0.83
624	0		150	0.21	230	1095	27.02	0	0.21

ESTIMATE OF STAGE-DISCHARGE IN PADANARAM BROOK

At Elev. 420 river thalweg. (Downstream from residential and commercial area)



River slope = 10' in 500' = 0.0167
 $S^{1/2} = 0.129$ $n = 0.075$
 $Q = \frac{1.486}{n} A R^{2/3} S^{1/2} = 19.8 A R^{2/3} S^{1/2}$

Elev.	d	Width	Average Width	D Area	W Area	Wetted Perimeter	Hyd. Rad	$R^{2/3}$	Q
420	0	40			0				0
425	5	60	50	250	250	62.4	4.0	2.52	1610
430	10	80	70	350	600	84.8	7.07	3.69	5650
435	15	200	140	700	1300	205.2	6.34	3.42	11370
440	20	360	280	1400	2700	365.5	7.39	3.79	26160

For 15' stage depth between reach from Brook from confluence to Padanaram Brook & Lake Margerie outlet channel to about 2000' from Interstate 84.

$L = \pm 7500'$ $A = \pm 130000 \text{ sq ft}$

River Storage = $\frac{7500 \times 1300}{43560} = 224 \text{ AF.}$

From Figure - reservoir evacuation will empty 224 AF in about 15 minutes. Outflow at 15 min. = $\pm 11,200 \text{ cfs.}$

River stage for $\pm 11,200 \text{ cfs}$ is $\pm 15'$



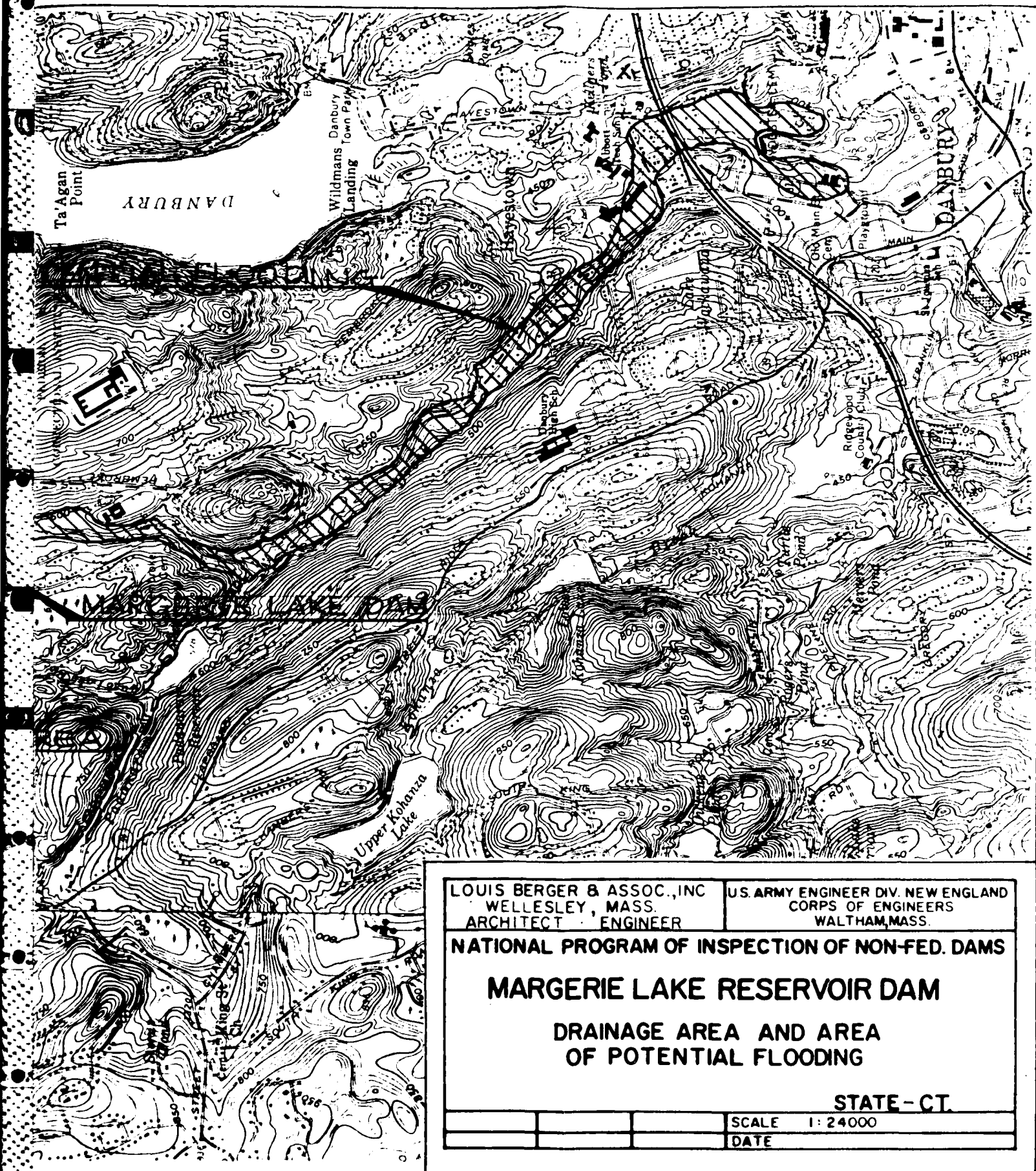


FIGURE 3

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

END

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